

*MANDS FOR INFORMATION GENERALIZE ACROSS  
ESTABLISHING OPERATIONS*

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The current study extends the literature on teaching mands for information by assessing whether mands generalize across different establishing operations (EOs). Three children with autism were taught to perform multiple behavior chains, 3 of which included a common response (e.g., “Where is the spoon?”) used for different purposes. An interrupted-behavior-chain procedure was used to contrive the EO for each mand. After teaching a mand for information under 1 EO, the remaining chains were interrupted to determine whether the mand had generalized to different EOs. For all participants, mands for information generalized across EOs. For 2 participants, a new mand-for-information topography emerged after training.

*Key words:* behavior chains, establishing operations, mands

When Skinner (1957) introduced the concept of the mand, he included in his definition the critical role that deprivation and aversive stimulation play in influencing its emission. Then Michael (1988) introduced the establishing operation (EO) concept in relation to the mand and expanded the analysis of the mand relation to include conditioned variables, highlighted the ubiquity of the mand in daily verbal interactions, and noted that most of the mands that people emit are mands for information. Mands for information allow the speaker to

react more precisely to the environment and may facilitate the acquisition of additional verbal behavior (Sundberg & Michael, 2001; Sundberg & Partington, 1998). For example, if an individual needs a hammer to hang a picture but does not know its location, a mand for the location of the hammer (“Where is the hammer?”) will help him or her to find the hammer more quickly than looking in multiple locations.

If a child is not familiar with the names of items, a mand for information (“What’s that?”) can help to expand his or her tact repertoire. The considerable role mands for information play in a verbal repertoire has implications for the development of language training programs for individuals with developmental disabilities. Several recent investigations have focused on teaching mands for information. For example, Williams, Donley, and Keller (2000) taught two 4-year-old girls with autism to ask three questions about hidden objects. The experimenters used echoic prompts to train the three response forms (“What’s that?”; “Can I see it?”; and “Can I have it?”). Correct responses produced the corresponding reinforcer: the item’s name, the sight of the item, and the item itself. The authors demonstrated successful acquisition and stimulus generalization (across settings and instructional agents) for each mand

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This article is based on a thesis submitted by the first author, under the supervision of the second author, in partial fulfillment of the requirements for the MA degree in psychology. We thank Jack Michael, Linda LeBlanc, and David Palmer for their helpful comments on an earlier version of the manuscript. We also thank Kelly Stone, Kelsey Behnke, Sadie Lovett, Adam Freeman, Laura Barnes, Laura Keinath, Nick Vandervliet, Abby Mercure, Amanda Smith, Jacquelyn Hoag, Tracy Lepper, Catrina Litzenberg, Stacy Ruse, and Amanda Stencel for their assistance with data collection, and Pat Oldham, Lori Sebright, Jessica Roberts, Tanya Beck, Bethany Kreps, Kathy Chambers, and Trish Walters for their on-site support.

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doi: 10.1901/jaba.2010.43-381

topography. Williams, Perez-Gonzalez, and Vogt (2003) conducted a systematic replication of the earlier study. After successfully teaching participants the three question forms, the experimenters varied the consequences to the second ("Can I see it?") and third ("Can I have it?") questions to determine whether the three questions were functionally independent, were part of the same response class, or belonged to a chain of responses. The results suggested that the three questions were functionally independent. In addition, the authors demonstrated that the mand for information ("What's in the box?") was influenced by an EO separate from those of the other two mands and that it generalized across the presentation of different items.

Sundberg, Loeb, Hale, and Eigenheer (2002) contrived EOs to teach mands for information to two young boys with autism. In their first experiment, participants were initially offered two to three preferred items and two to three neutral items in a box, one item at a time. Participants were then offered empty boxes during baseline and intervention phases to contrive the relevant EO. The experimenters then used echoic prompts to teach the mand "Where is the —?" for one preferred and one neutral item. Correct responses and successful imitation of the experimenter's prompts produced information about the location of the missing item. Both participants learned to successfully mand for information regarding the location of the preferred and neutral missing items. Acquisition of the preferred and neutral items was comparable with respect to number of sessions to mastery. One participant successfully manded for the location of two new items without direct training. The authors then replicated these procedures in a second experiment in which they trained the participants to mand "Who has the —?" Both participants acquired the "who?" mand and emitted it when untrained novel items were used. In summary, Sundberg *et al.* demonstrated that contriving the EO was an effective way to train mands for

information and that, for some individuals, mands for information generalize across response topographies.

Endicott and Higbee (2007) replicated the Sundberg *et al.* (2002) study with three children with autism. Items were hidden to contrive the relevant EO. During the intervention phase, echoic prompts were used to train the "where?" mand for information. All three participants learned to emit the mand for information after the intervention. Generalization across settings and instructional agents was observed for the participants for whom generalization probes were conducted. In a second experiment the authors taught the "who?" mand using echoic prompts. Following the intervention, all three participants emitted the "who?" mand. These results further demonstrated that manipulation of the EO was an effective method for training mands for information and that for some individuals, generalization across settings and instructional agents was observed.

In the Sundberg *et al.* (2002) and Endicott and Higbee (2007) studies, the terminal reinforcer (access to a toy) and the immediate reinforcer (information about the toy's location) were identical for all of the items, indicating that the same EO influenced all of the targeted mands. Generalization across response topographies was observed for the "where?" mand for one participant in the Sundberg *et al.* study and for two participants in the Endicott and Higbee study, and for the "who?" mand for two participants in the Sundberg *et al.* study. In addition, Williams *et al.* (2000) and Endicott and Higbee demonstrated generalization of mands for information across settings, instructional agents, and items.

The four aforementioned studies demonstrated that mands for information may generalize across response topographies and other stimulus features. However, the EOs for the different target items in all of the studies were functionally similar (e.g., "Where is frog?"; "Where is ball?"). A more fundamental ques-

tion is whether mands for information generalize to different EOs (e.g., manding for the location of a newspaper when the relevant EO is reading the newspaper and then at another time when the relevant EO is using it for an art project). Current clinical practice involves training a mand for information under one EO (Sundberg & Partington, 1998). If it is the case that mands do not generalize across EOs, then current clinical practice may need to be modified. Thus, the present study sought to extend the developing literature on teaching mands for information by assessing whether they also generalize to different EOs.

## METHOD

### *Participants, Settings, and Materials*

Three boys with prior diagnoses of autism participated in this study. To confirm these diagnoses, the experimenter assessed each participant with the Gilliam Autism Rating Scale-2 (Gilliam, 1995). Each participant had an autism quotient that fell within the moderate to upper moderate range, suggesting that all of them displayed characteristics commonly observed in individuals with autism, with deficits especially pronounced in communication.

Matt was 4 years 6 months old. His parent reported that he emitted few vocal mands. His Behavior Language Assessment Form (BLAF; Sundberg & Partington, 1998), which was completed by his classroom teacher, revealed that he was able to emit at least 100 tacts, was able to fill in or answer 20 questions, and had a moderate mand repertoire in which he occasionally manded for a few select items or activities (e.g., candy, potty). He did not emit any mands for information.

John was 4 years 6 months old. An informal interview with a parent revealed that he was able to vocally mand for items. In addition, his parent reported that he began emitting the "where?" mand 2 months prior to the study. John's BLAF, which was completed by his

classroom teacher, revealed that he had over 300 tacts, an emerging intraverbal repertoire, and an extensive mand repertoire.

Anthony was 7 years old. An informal interview with a parent revealed that Anthony typically requested items using vocal mands. The parent interview and a quick informal assessment revealed that he was also able to emit the "where?" mand. Anthony's BLAF, which was completed by his parent, revealed that he was able to emit at least 100 tacts, was able to answer 30 questions, and had an extensive mand repertoire in which he used five to 10 words to mand for a variety of activities and reinforcers.

All experimental sessions were conducted in a small conference room at the participants' school for Matt and John and in a small room for Anthony. Sessions were conducted with two to four experimenters present and seated on both sides of the participant at a table. One experimenter implemented the procedures while the remaining experimenters collected data. Contriving the relevant EO for the participants involved hiding the target item in a designated hiding location (e.g., the spoon was hidden in one of three different colored drawers or a box) or on the person of one of the other experimenters. Sessions were conducted three to four times per week and lasted approximately 60 min.

### *Behavior Chains*

*Materials.* Various materials were used to teach different behavior chains. The volcano chain included a small box of baking soda, a small bottle of vinegar, a clear plastic cup, a plastic spoon, and various food dyes. Materials for the spoon-doll chain included a spoon, colorful pipe cleaners, and happy face stickers. The ice cream chain involved a bowl, a napkin, a plastic spoon, and ice cream. The truck chain involved a toy truck and a small remote control. The strawberry or chocolate milk chain included a clear plastic cup, a plastic spoon, milk, and strawberry or chocolate syrup. The table-setting

Table 1  
Description of Target and Control Behavior Chains

| Participant | Chain           | Description  | Function             | Terminal reinforcer                |
|-------------|-----------------|--|----------------------|------------------------------------|
| Matt        | Volcano         | Remove lid from bin  | Target               | Volcano erupting                   |
|             |                 | Remove cup and spoon from bin  |                      |                                    |
|             |                 | Remove baking soda and vinegar from bin                                      |                      |                                    |
|             |                 | Scoop baking soda and pour in cup  |                      |                                    |
|             |                 | Squeeze food coloring in cup   |                      |                                    |
|             | Strawberry milk | Remove lid from bin  | Generalization probe | Consumption of milk                |
|             |                 | Remove cup and spoon from bin  |                      |                                    |
|             |                 | Stir strawberry syrup in milk (after experimenter put milk and syrup in cup) |                      |                                    |
|             | Table setting   | Remove lid from bin  | Generalization probe | Consumption of snack               |
|             |                 | Remove placemat, fork, knife, cup, and spoon                                 |                      |                                    |
|             |                 | Place all utensils in designated outlined locations on the placemat          |                      |                                    |
| John        | Puzzle          | Eat snack  | Control              | Completion of puzzle               |
|             |                 | Remove lid from bin  |                      |                                    |
|             |                 | Remove puzzle board and 3 pieces   |                      |                                    |
|             |                 | Complete puzzle  |                      |                                    |
|             |                 | Described above  |                      |                                    |
|             | Ice cream       | Remove lid from bin  | Generalization probe | Consumption of ice cream           |
|             |                 | Remove bowl and spoon from bin   |                      |                                    |
|             |                 | Scoop ice cream (after experimenter put ice cream in bowl)                   |                      |                                    |
|             | Spoon doll      | Remove lid from container  | Generalization probe | Playing with or keeping spoon doll |
|             |                 | Remove spoon, 2 pipe cleaners, and face sticker                              |                      |                                    |
|             |                 | Peel off sticker and place on large end of spoon                             |                      |                                    |
| Anthony     | Truck           | Twist both pipe cleaners around spoon handle                                 | Control              | Playing with truck for 5 min       |
|             |                 | Remove lid from bin  |                      |                                    |
|             |                 | Remove truck   |                      |                                    |
|             |                 | Remove remote control  |                      |                                    |
|             |                 | Described above  |                      |                                    |
|             | Volcano         | Described above  | Target               | See above                          |
|             |                 | Described above  |                      |                                    |
|             |                 | Described above  |                      |                                    |
|             | Chocolate milk  | Described above  | Generalization probe | Consumption of milk                |
|             |                 | Described above  |                      |                                    |
|             | Table setting   | Described above  | Generalization probe | Consumption of snack               |
|             | Truck           | Described above  | Control              | See above                          |

chain included a yellow placemat with outlines for the corresponding items for the place setting, plastic utensils (i.e., a spoon, knife, and fork), a paper cup, and a paper plate. Materials for the puzzle chain included the puzzle board and three puzzle pieces. During the interrupted-behavior-chain procedure, hiding places included three different-colored drawers (red, yellow, green) and a medium-sized cardboard box.

*Response measurement.* Prior to the evaluation, participants were trained to complete each activity chain, each of which involved three to six steps (described in Table 1). Independent responses were defined as initiation of the behavior chain within 5 s of the experimenter’s instruction (e.g., “make a volcano”) and the unprompted completion of each remaining

response of the chain, with each response being completed within 5 s of the previous response.

*Behavior-chain training.* Prior to behavior-chain training, the experimenters conducted informal tact and receptive identification assessments with the stimuli that were included in the study (detailed procedures available the second author). A total-task-presentation procedure was used to teach all behavior chains. Behavior chains were selected based on their developmental appropriateness for each participant and on observations of the participants’ preferences for each of the activity chains. A behavior chain consisted of removing the lid of the plastic container, removing the materials from inside the plastic container, and then using the materials to complete the chain in a stepwise manner. For example, the volcano chain

consisted of removing the lid of the plastic container; removing the cup, spoon, and baking soda from the container; and using the spoon to scoop out the baking soda and place it in the cup. The experimenter assisted the participant with the rest of the chain (i.e., adding food coloring and pouring the vinegar; see Table 1).

The experimenter first provided an instruction for each behavior chain (e.g., "make a volcano"). The experimenter then modeled the behavior chain. Afterward, the experimenter provided the instruction again, presented the participant with the plastic container with the corresponding materials inside, and allowed the participant to engage in the behavior chain while providing verbal and gestural prompts as necessary. Prompted completion of a behavior chain resulted in an unenthusiastic statement about the chain (e.g., "You made a volcano," "You made a doll"). Independent completion of the chain resulted in enthusiastic praise regarding his performance (e.g., "Wow! You made the volcano all by yourself!"). The mastery criterion for each behavior chain was independent completion of the chain three consecutive times across 2 days. Praise was delivered at the end of the behavior chains during the behavior-chain training condition while the participant learned the behavior chain and emission of the behavior chain came under the control of the terminal reinforcer. However, it is important to note that praise was not delivered during baseline, mand-for-information training, and generalization probes.

#### *Data Collection*

*Response measurement.* During baseline, mand-for-information training, and posttraining generalization phases, the experimenter recorded whether the participant emitted the corresponding mand for information. Responses were recorded as correct or incorrect after each trial. Correct responses were those that included full mands. The full mand for information consisted of "where?" or "who?" plus the name of the object (e.g., "Where spoon?" or "Who has the

spoon?"). For Matt, a correct response was recorded if he said "Where is spoon?" within 10 s of the previous step in the chain. For John, a correct response was recorded if he said "Who has spoon?" within 10 s of the experimenter's response, "One of your teachers has the spoon." For Anthony, a correct response was recorded if he said "Who has the spoon?" within 10 s of the experimenter's response, "One of your teachers has it." The article "the" as part of the response was required for Anthony only. The response was recorded as incorrect if the participant did not emit the full mand for information within 10 s of the previous step in the chain or within 10 s of an experimenter's response; if the participant said only the name of the missing item (e.g., "spoon?") or said only "where?" or "who?"; or if the participant made any response other than the full mand.

*Interobserver agreement.* A second observer independently recorded data during behavior-chain training, baseline, direct training of the mand for information, and generalization probe phases for Matt, John, and Anthony. An agreement was scored for each trial in which the experimenter and the observer both recorded a correct or incorrect response. Point-by-point agreement was calculated for each session by dividing the number of trials with agreements (on correct and incorrect responses) by the sum of trials with agreements and trials with disagreements, and this ratio was converted to a percentage. Agreement was assessed for 100% of Matt's behavior-chain training trials and was 97%. Agreement was assessed for 95% of Matt's baseline, training, and generalization probes and was 100%. Agreement was assessed for 100% of John's behavior-chain training trials and was 100%. Agreement was assessed for 100% of John's baseline, training, and generalization probes and was 100%. Agreement was assessed for 69% of Anthony's behavior-chain training trials and was 100%. Agreement was assessed for 92% of Anthony's baseline, training, and generalization probes and was 99%.



### *Procedure*

*Stimulus preference assessment.* The natural consequences for the behavior chains were used as reinforcers, with the exception of the table-setting chain. The natural consequences for the behavior chains included eruption of the volcano for the volcano chain, consumption of milk for the strawberry or chocolate milk chain, puzzle completion for the puzzle chain, consumption of ice cream for the ice cream chain, playing with and keeping the doll for the spoon-doll chain, and playing with the truck for the toy truck chain. We assumed that natural consequences would maintain the behavior chains either because the participants' parents reported that these stimuli were preferred (flavored milk, ice cream, toy truck, puzzle), or we directly observed positive responses to these stimuli (smiling, clapping, and positive remarks during the volcano chain and unprompted play during the spoon-doll chain). Food items and drinks were delivered after completion of the table-setting chain because, although the sight of a completed table setting may come to function as a conditioned reinforcer over time, we did not assume that this would function as a reinforcer in the short term with our participants. In the natural environment, a completed place setting is typically followed by the consumption of food and drink. Therefore, children received a snack and drink after completing the table-setting chain. We also used snacks during breaks throughout each session. To identify food that would contribute to the maintenance of the relevant EO for Matt and Anthony during the table-setting chain and be made available to Matt, John, and Anthony during breaks throughout the sessions, parents nominated a list of three to five preferred edible items by completing the Reinforcer Assessment for Individuals with Severe Disabilities (Fisher, Piazza, Bowman, & Amari, 1996). These items were then used to conduct a multiple-stimulus (without replacement) preference assessment

using procedures described by Carr, Nicolson, and Higbee (2000). Selection percentages were calculated by dividing the total number of instances an item was selected by the total number of choice trials in which the item was presented and converting the ratio to a percentage. A one-array assessment (Carr *et al.*) using the three food items with the highest selection percentages was conducted before each session to ensure that the relevant EO was present during training.

*Echoic, tact, and listener assessment.* After the preference assessment had been conducted, the experimenter conducted an informal echoic assessment with each participant. The experimenter read a list of items that were used in training each behavior chain including the target words "where," "who," "cup," and "spoon." The experimenter asked the participant to repeat each word (e.g., "Say 'cup'"). This assessment was conducted to ensure that the participants were able to respond to the echoic prompts (e.g., "Say 'Who has the spoon?'" used in training. All three participants were able to imitate all of the experimenter's responses including short phrases (e.g., "Where is cup?").

*Experimental design.* A nonconcurrent multiple-baseline design across participants was used to demonstrate the effects of the intervention. Within each participant, concurrent baselines were used to evaluate the effects of mand-for-information training across EOs for a single response topography (e.g., "Where is the —?" and "Who has the —?"). Matt was trained to emit the "where?" mand under one EO, and probes for generalization to two other EOs were conducted afterward. John and Anthony were trained to emit the "who?" mand under one EO, and probes for generalization to two other EOs were conducted afterward. To further control for the possibility that the participant would learn the mand for information as a generalized mand for assistance with missing objects, a fourth control chain was added to ensure that the mand for information was

emitted under the influence of the relevant EO. That is, if a participant would have emitted the target mand for information consistently during the control chain (e.g., manding "Who has the spoon?" when the truck was missing), it would have been difficult to determine if the mand had been emitted under the influence of the relevant EO (e.g., wanting to know the location of the truck).

*Experimental conditions.* During baseline, an interrupted-behavior-chain procedure was implemented (Shafer, 1994). The experimenter provided the participant with the instruction appropriate to the chain (e.g., "make a volcano"). The spoon was withheld and hidden from the participant in one of the aforementioned designated hiding places. If Matt failed to emit the "where?" mand for the location of the spoon or the missing item in the control chain within 10 s of completing the previous step, the experimenter terminated the behavior chain and introduced a new behavior chain. John and Anthony manded, "Where is [the] spoon?" after reaching the step in the chain during which the target item was required. In response to this mand for information, the experimenter provided the stimulus, "One of your teachers has it," after which John and Anthony had 10 s to emit the target mand for information, "Who has [the] spoon?" If John and Anthony failed to emit the mand for the individual who had the missing spoon or item from the control chain within 10 s of the experimenter's response ("One of your teachers has it"), the experimenter terminated the behavior chain and introduced a new behavior chain. For all three participants, emission of the target mand for information produced information regarding the location of the missing item (e.g., "It's in the red box" or "Yellow has it"). Each of the four chains was presented in every session in an alternating format (e.g., volcano, chocolate milk, doll, truck).

Baseline probes were interspersed with completed chains in an effort to maintain the

relevant EO. The experimenters were concerned that if the participants were repeatedly unable to complete the behavior chains, it might possibly abolish the reinforcing value of chain completion (data for the interspersed completed chains are not included as part of the current analysis). The completed chains were the same chains targeted in the study but with none of the materials missing so that the participants could successfully complete the chain independently. For example, the experimenter presented the following sequence in a given baseline session with John: probe volcano chain, completed doll chain, probe chocolate milk chain, probe volcano chain, completed chocolate milk chain, probe doll chain, probe control (truck) chain, completed volcano chain. Approximately 2 to 5 min elapsed between trials.

Mand-for-information training began with an interrupted-behavior-chain procedure as in baseline. The experimenter first intervened on the volcano chain to train the mand for information for Matt, John, and Anthony. The experimenter said "make a volcano." During the first opportunity to perform the chain, when Matt completed the step just before the step that required a spoon, the experimenter immediately provided an echoic prompt to train the mand, "Where is spoon?" When John and Anthony completed the step just before the step that required a spoon, they would emit the mand for information, "Where is [the] spoon?" to which the experimenter provided the response "One of your teachers has it." At this point the experimenter immediately provided an echoic prompt to train the mand, "Who has [the] spoon?" The experimenter provided the participant with the location of the spoon after successful imitation of the prompt. During the next opportunity to perform the volcano chain, the experimenter used a prompt delay and waited 2 s before providing the echoic prompt.

For Matt, successful emission or imitation of the "where?" mand produced the name of the location where the item was hidden (e.g., "It's

in the green drawer"). During John's and Anthony's sessions, two or three experimenters wore a yellow, red, or blue T-shirt in an effort to simplify for John and Anthony the task of identifying the individual with the missing item. For John and Anthony, successful emission or imitation of the "who?" mand produced the T-shirt color of the experimenter (i.e., "teacher") who had possession of the spoon (e.g., "Blue has the spoon"). A prompt delay greater than 2 s was never required for any of the participants. The mastery criterion for this phase was independently manding for the location of the spoon within 10 s of the previous step or within 10 s of the experimenter's response for five consecutive complete chains across 2 days.

After the mand for information had been trained successfully under the first EO (i.e., the volcano chain), generalization probes were conducted using the trained chain (volcano chain); the other two behavior chains that involved the use of the spoon for different purposes; and the control chain which, as stated previously, did not involve the use of the spoon. In addition, as was the case during baseline, generalization probes were interspersed with completed chains. Correct mands for information for all four chains (the three chains that involved the use of the spoon and the control chain) produced information regarding the location of the missing item. The experimental preparation for these probes was identical to baseline.

The number of trials conducted per session during all phases of the study was determined by the length of the session and participant behavior. During baseline probes, a trial was defined as delivery of the instruction by the experimenter and the initiation of the behavior chain. During mand-for-information training and posttraining generalization probes, a trial was defined as delivery of the instruction by the experimenter, initiation of the behavior chain, the mand for the location of the missing item,

and completion of the entire response chain. A session was terminated after approximately 60 min or when the participant indicated that he wanted to leave (e.g., asking to go back to class). The mean number of trials completed during a session was 7 (range, 5 to 11).

### *Procedural Fidelity*

In an effort to ensure correct implementation of the procedures during the behavior-chain training, baseline, mand-for-information training, and generalization probes, a second observer was present and recorded antecedents and consequences delivered by the experimenter on each trial. A trial was scored as correct if the experimenter delivered the instructions, prompts, and consequences appropriate to the phase and the child's response. Procedural fidelity was calculated for each session by dividing the number of correctly implemented trials by the total number of trials and converting the ratio to a percentage. Procedural fidelity was assessed for 96% of trials for Matt and was 93%. Procedural fidelity was assessed for 100% of trials for John and was 99%. Procedural fidelity was assessed for 86% of trials for Anthony and was 100%. Point-by-point interobserver agreement was assessed on procedural fidelity data collected for 59%, 36%, and 32% of procedural fidelity trials for Matt, John, and Anthony, respectively. Agreement on procedural fidelity data was 100% for all three participants.

## RESULTS

Results for all three participants' performances of the target mand for information during baseline and after training are depicted in Figure 1. During baseline, all three participants failed to emit the target mand for information ("Where is spoon?" for Matt, and "Who has [the] spoon?" for John and Anthony). John required 14 trials across 4 days and Anthony required 22 trials across 3 days to reach mastery criterion for the target mand for information ("Who has [the] spoon?"). Matt required 11



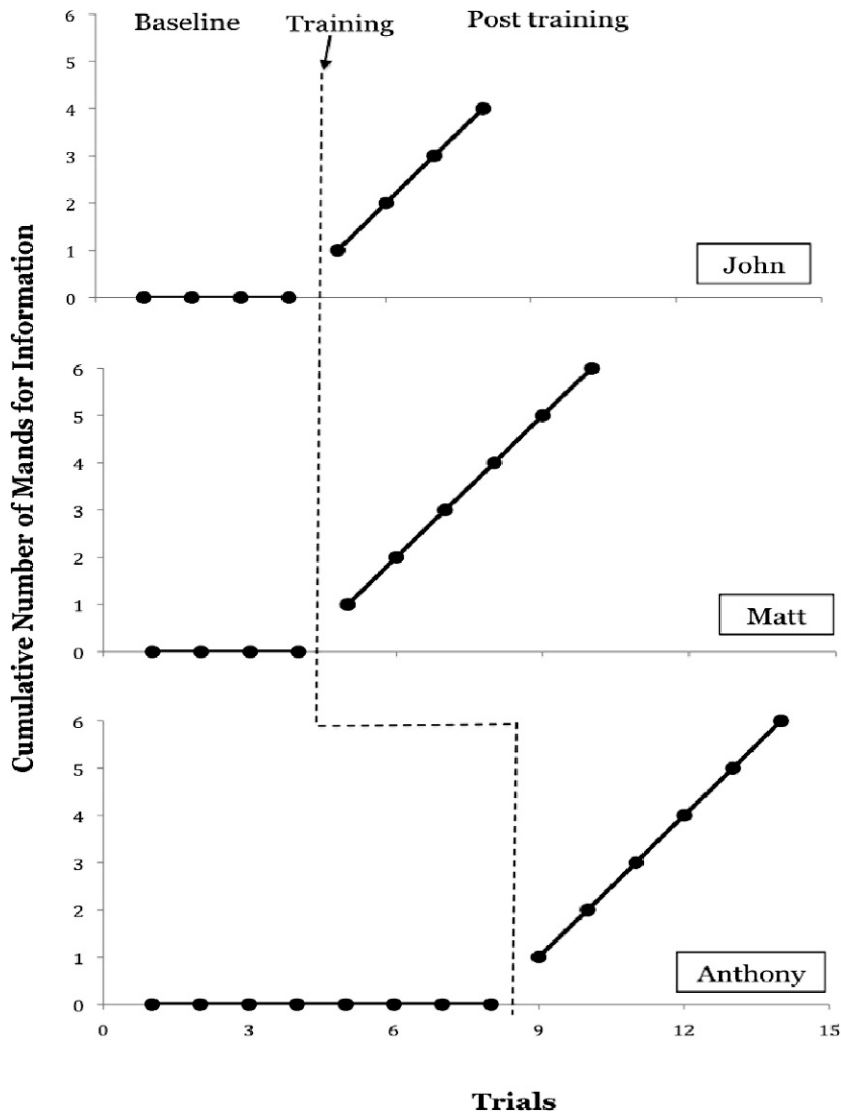


Figure 1. Cumulative correct mands for information across baseline and generalization probes for the target EO for Matt, John, and Anthony.

trials across 3 days to reach mastery criterion for “Where spoon?” and 10 trials across 2 days to reach mastery criterion for “Where four?” Thereafter, all three participants emitted the mand only after the intervention had been implemented.

Individual results for John, Matt, and Anthony are depicted in Figures 2, 3, and 4, respectively. In analyzing the data, note that for all three participants, observations of the chains

were staggered to depict the order in which the observations were conducted across the chains. As a result, there are slightly different slopes across the panels, which is related to the manner in which the data are displayed as opposed to different response frequencies. During baseline, John, Matt, and Anthony failed to emit the target mand for information (“Where is spoon?” or “Who has [the] spoon?”). These results indicate that John and Anthony were

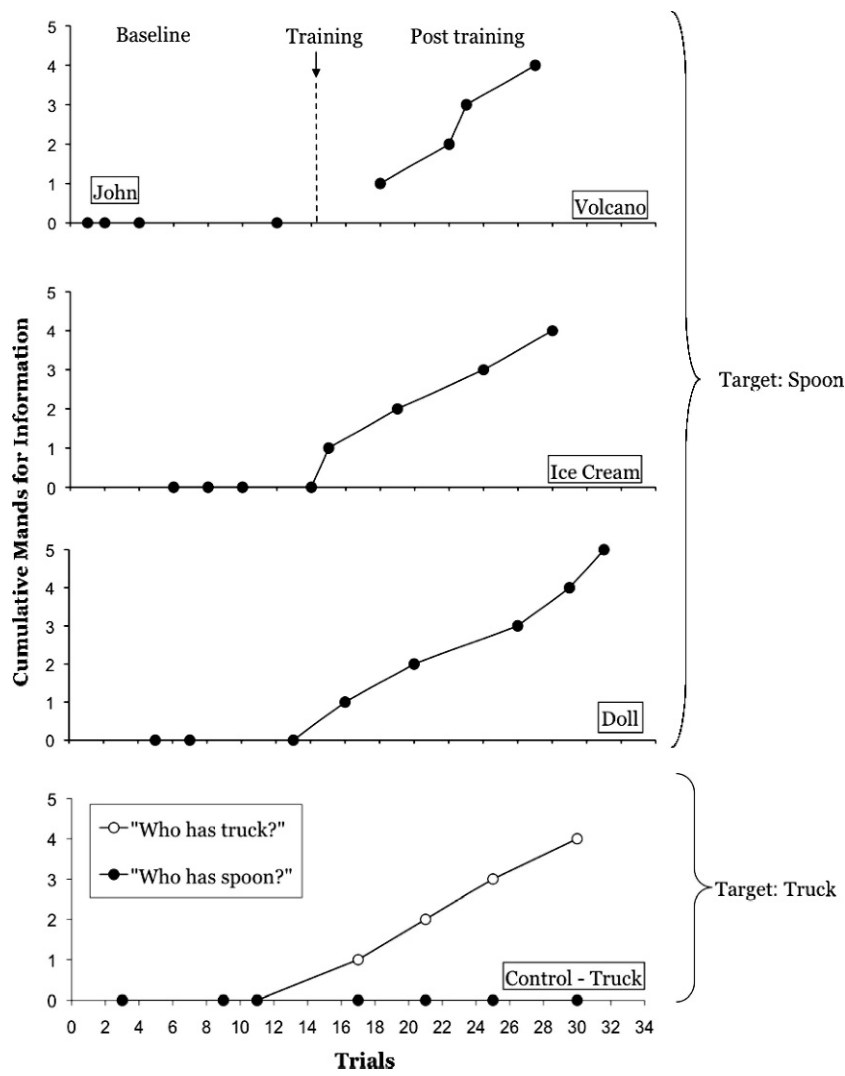


Figure 2. Cumulative correct mands for information across baseline and generalization probes for John. The data depicted in the top panel are also depicted in the top panel of Figure 1.

unable to emit the “who?” mand for the spoon or the truck, and Matt was unable to emit the “where?” mand for the spoon or the puzzle piece prior to intervention. All three participants initiated the chain during baseline, and when they failed to emit the mand for information, the experimenter terminated the chain. (Only the emission of the mand-for-information responses is depicted on the graphs. Behavior-chain performance data are available from the second author.) The second and third panels in Figures 2, 3, and 4 represent behavior

chains that required the use of a spoon (e.g., table-setting chain, ice cream chain, spoon-doll chain), and thus represent EOs different from those in the first panel (the volcano chain). The mand for information was not emitted during these chains until after it was taught for the target chain, suggesting that the mand generalized across EOs. During the generalization probes (Panels 2 and 3), the participants completed the behavior chains after retrieving the missing items (data not shown, but are available from the second author).

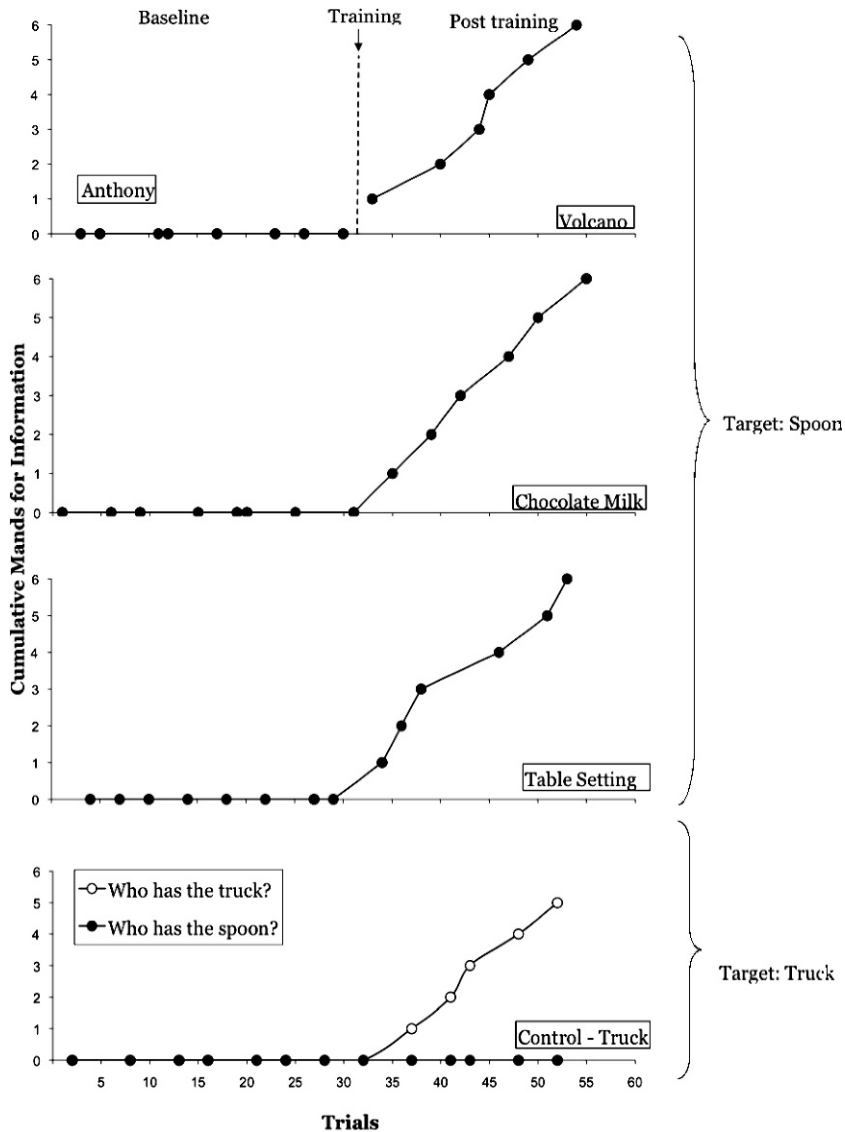


Figure 3. Cumulative correct mands for information across baseline and generalization probes for Matt. The data depicted in the top panel are also depicted in the middle panel of Figure 1.

The fourth panels of Figures 2, 3, and 4 represent the control chain, which did not require the use of the spoon, and thus show response topographies and EOs different from those in the first panel. For John and Anthony, there are two data paths. The filled circles represent the “Who has [the] spoon?” mand, and the open circles represent the “Who has [the] truck?” mand. During generalization

probes with the control chain, John and Anthony did not emit the “Who has [the] spoon?” mand but, interestingly, they emitted the “Who has [the] truck?” mand in the absence of additional training. As was the case for the other two chains that involved the use of the spoon, John and Anthony completed the control chain (i.e., playing with the truck and remote control) after retrieving the truck from

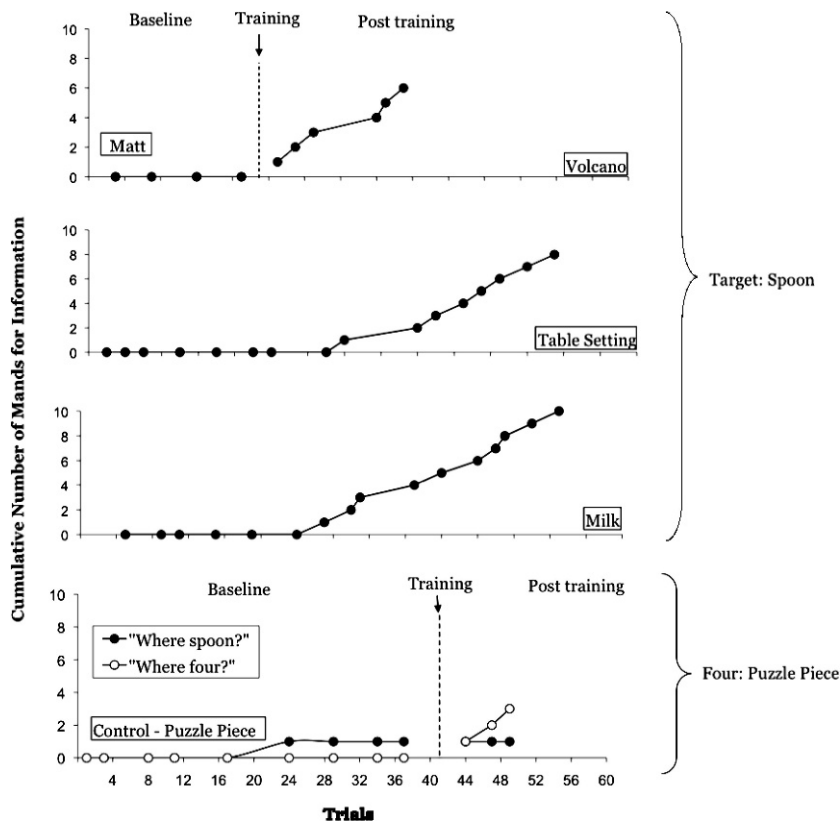


Figure 4. Cumulative correct mands for information across baseline and generalization probes for Anthony. The data depicted in the top panel are also depicted in the bottom panel of Figure 1.

the experimenter. For Matt, there also are two data paths. The filled circles represent the “Where spoon?” mand, and the open circles represent the “Where four?” mand. During generalization probes with the control chain, on most trials Matt emitted the mand for the stimulus itself (“four?”). During the second trial, Matt emitted the “Where spoon?” mand for information and the mand for the stimulus itself (“four?”). The mand for information “Where spoon?” was immediately followed by the mand “four?” suggesting that the relevant EO was present. During the third trial, Matt emitted the mand for the item itself, “four?” and then emitted the instruction for the chain (“Put it together”). The mand for information for the control-chain stimulus (“Where four?”) required additional training using procedures

described in the mand-for-information training section above. Following training, Matt emitted correct mands for the missing puzzle piece.

DISCUSSION

The results of the current experiment extend the existing literature on mand-for-information training by demonstrating generalization of mands for information about specific objects across EOs. In addition, generalization of the mand for information across response topographies was observed for two of three participants, lending further evidence to the occurrence of this phenomenon observed in previous studies (Endicott & Higbee, 2007; Sundberg et al., 2002; Williams et al., 2000). These findings have a number of potential implications for

practice. Current clinical practice involves training one mand-for-information topography under a single EO (Sundberg & Partington, 1998). The present study supports this practice. It is interesting to note that generalization of mands for information across EOs was demonstrated by individuals with very different verbal repertoires. John and Anthony had more advanced verbal repertoires, and Matt's was comparatively weaker. This finding may suggest that mands for information are a more flexible response than typically considered in early and intensive behavioral intervention programs; thus, it may be possible to target this response earlier in an individual's curriculum.

It is important to note differences observed in the participants' performances during the control chain. Matt's responding did not generalize across response topographies, but John's and Anthony's did. After the experimenter directly trained the mand for information for the second response topography (puzzle piece: "four") with Matt, he was able to emit the mand for information for the puzzle piece. Below we offer one conceptual framework through which to understand the differences in the performances between Matt and Anthony and John for the control chains.

It may be beneficial to conceptualize the mand for information as a partial autoclitic frame (Skinner, 1957). Autoclitic responses are those responses that further describe or qualify other verbal behavior and, thus, alter responding of the listener. Thus, an autoclitic frame addresses the unitary function of verbal behavior. For example, the phrase "Come and get it!" is functionally equivalent to the response "food!" Skinner argued that grammatical or syntactical analysis of "Come and get it!" is unimportant, and the functional unity of the phrase is where the focus of the analysis should lie. As an individual's verbal repertoire continues to grow, these functional units continue to expand as well. Relational autoclitic frames are also involved when a partial autoclitic frame

(e.g., "Where is?") is combined with responses appropriate to the specific situation (e.g., "spoon"). Several responses involving the partial autoclitic frame must be acquired before the individual is able to emit a novel response within this partial frame (Egan & Barnes-Holmes, 2009; Skinner).

In Matt's case, two EOs likely evoked the mand for information ("Where spoon?"). The missing item functioned as the relational aspect of the situation that evoked the "where?" mand, and the missing item (a spoon specific to the experimental condition) is the feature that evoked the response "spoon." Matt was able to emit this response after direct training under one EO and when his behavior was probed under other conditions in which the spoon was required. The EOs represented by the different activity chains were functionally similar enough to evoke "spoon." Matt's emission of "Where spoon?" during the control puzzle chain may indicate that he had failed to learn the response as a partial autoclitic frame. His emission of the mand for the appropriate item following the "Where spoon?" mand (e.g., "four") indicated that the mand was under the control of the relevant EO. Thus, the specific situation (i.e., missing puzzle piece) did influence the emission of the mand for the appropriate stimulus ("four?"). Interestingly, although Matt's mand for information did not generalize across response topographies, his mands generalized across response topographies as evidenced by the emission of the mand for the correct missing item with the puzzle ("four?"). This may lend support for the notion that, for Matt, the "Where spoon?" mand was functionally equivalent to the mand "where?"

According to Skinner's (1957) analysis, John and Anthony acquired the mand for information ("Who has the spoon?"), as is evidenced by generalization of the mand for information across response topographies ("Who has the truck?"). John and Anthony had more advanced verbal repertoires than Matt, and they both had



an emerging mands-for-information repertoire, in that they were able to emit the “where?” mand prior to participation in the current study. It is possible that John and Anthony had learned a series of responses with the autoclitic frame “where?” (e.g., “Where is juice?”; “Where is truck?”; and “Where is mommy?”) before they were able to emit a novel response with this autoclitic frame, which may have accounted for the results obtained for those participants.

A discussion of a procedural limitation of this study is warranted. Due to practical constraints, mand-for-information training was conducted with Matt and John on the same day, which represented the same point in time of their baseline phases. This limited the demonstration of experimental control to only one replication, which, in turn, limits the number of convincing demonstrations of the functional relation between training and the observed changes in manding behavior.

In conclusion, the results of this study suggest that mands for information generalize across EOs for learners with varying verbal repertoires. Although generalization of mands for information across response topographies was not observed for Matt, the generalization of mands (i.e., mands for items) across response topographies was observed in his case. Simple mands are mands for items or activities (e.g., “Cookies, please?”) in contrast to mands for information about items or activities (e.g., “Where are the cookies?”). In addition, the generalization of mands for information across response topographies was observed for John and Anthony. The results of this study suggest that mands and mands for information are functionally distinct but related responses and that some mands for information may be conceptualized as partial autoclitic frames. Thus, it may be the case that different EOs for the same item are functionally similar enough to reliably evoke the specific mand for the item itself. Further research on the generalization of simpler mands (mands for

items or activities) across EOs may be warranted to separate the effects of the influence of the EO on the mand response and the acquisition of a partial autoclitic frame. Additional research investigating those variables that contribute to generalization of mands for information across response topographies is also warranted. It would be beneficial to identify those verbal skills that contribute to generalization of mands for information across response topographies. It may be that a more extensive autoclitic repertoire may function as a prerequisite skill for generalization of mands for information across response topographies. This information may be beneficial to clinicians in helping them identify the appropriate time in an individual’s program to target mands for information or target those prerequisite skills that will contribute to generalization of the mand for information across response topographies.

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*Received November 21, 2007*

*Final acceptance October 27, 2009*

*Action Editor, Henry S. Roane*